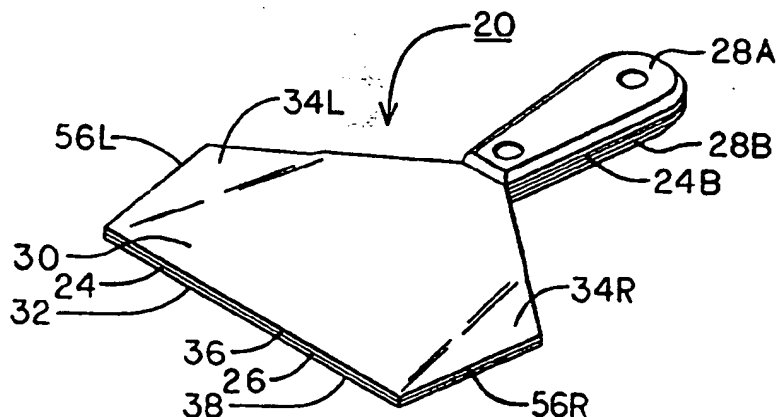




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(54) Title: ADJOINING SURFACE DEVICE FOR WORKING VISCOUS MATERIALS



(57) Abstract

A device is provided for applying and/or finishing viscous materials along at least one adjoining surface or a bead along a corner, while simultaneously effecting all of the surfaces substantially free of excess of the viscous material. The device includes a reinforcing portion (24), at least one operative extension (34R), (34L) with a working edge (56R), (56L) that protrudes beyond the termination (out of view) of the reinforcing portion, and a forward working edge (36), (38). The viscous material is formed with the forward edge. The angle of the operative extension edge to the forward edge is variable and resilient, which can conform to irregularities of the corner and variations in the position of the reinforcing portion and the forward working edge in relation to the adjoining surface, while sidewardly force is maintained against the adjoining surface. A seal is produced and maintained between the extension edge and the adjoining surface. The seal can continuously prevent the viscous material from oozing between the extension edge and the adjoining surface, whereby a uniform clearly defined junction of the applied or worked surface and the substantially clean and unscathed adjoining surface is easily and efficiently produced.

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ADJOINING SURFACE DEVICE FOR WORKING VISCOUS MATERIALS***Background-Field of Invention***

Continuation-In-Part of United States of America Application Serial No.:
07/880,571, Filed 1992 May 8.

This invention relates to the building and construction arts, specifically to devices which are particularly effective in applying and finishing viscous materials along at least one adjoining surface, which are easy to use and efficient in producing a uniform, clearly defined continuous junction of the applied surface and the adjoining surface, while simultaneously all of the surfaces are effected substantially free of any excess of the material being applied.

Background-Description of Prior Art

Heretofore, tools or other devices and methods for applying and finishing drywall joint compounds, spackle, plaster, cement, concrete, caulking, thinset, tile grout, other grouts, adhesives, resins, mastics, or other viscous materials, along at least one adjoining surface, have not been easy to use or efficient in effectively producing a uniform, clearly defined junction of the applied surface and the adjoining surface (here after to be referred to as adjoining surface), while simultaneously all of the surfaces are effected substantially free of any excess viscous material. Some of the commonly used tools for this process are a drywall taping knife or finishing knife, a float

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or finishing trowel for cement, a float or finishing trowel for plaster, a putty knife, etc., which have a semirigid, flat blade with rigid side edges at about 90 degrees to a straight forward working edge. For Example, during original construction and repair work, interior and exterior corners are frequently encountered where the surface to be worked upon more or less butts up against an adjoining surface. Some of the frequently encountered corners are where one wall adjoins either the ceiling, floor or another wall; where a wall meets a door casing, window frame, crown and base moulding, coving or wainscoating; where a window sill and/or jam meets a window frame; where a concrete slab meets a wall, or any other instance where a corner exists.

A two step operation for each application of material has been necessitated, by the fact that in the first step, the prior art devices currently in use fail to compensate for corner surface irregularities, thereby, depositing excess material upon the adjoining surface. This results in additional time and labor being spent to remove the excess material in the second step of the operation. In addition the second step exacerbates the possibility of physical disorders and injuries resulting from prolonged repetitive motions, e.g. carpal tunnel syndrome, grip loss, joint irritation and inflammation, etc.

Heretofore, tools or other devices and methods for forming a bead of caulking, sealants, or other viscous materials along a corner have not been easy to use or efficient in effectively producing uniform, clearly defined continuous junctions of the applied bead surface and the adjoining surfaces, while simultaneously effecting all of the surfaces substantially free of any excess of the material being applied. Some of the commonly used tools for this process are a wet sponge, one's finger, or a putty knife, which are cumbersome and relatively ineffective. For example, during original construction and/or repair work, interior and exterior inside corners are frequently encountered where there is an undesirable crack, seam, and/or irregularities at a corner. A bead of caulking is dispensed along the corner. The bead of caulking is then usually formed into a continuous uniform surface along the corner. The formed bead is intended to conceal the crack, seam, and/or irregularities of the corner. Often the formed bead is to remain unpainted or otherwise aesthetically blended with the adjoining surfaces. In most cases, the formed bead surface and the adjoining surfaces are desired to have clearly defined continuous corners, and to be free of excess viscous material. The various prior art devices used for this process do not produce the desired results

easily and efficiently.

Background-Prior Art Patents

I have not found any prior art patents directly germane to my invention, although inventors have created several types of devices with some similar features to that of my above patent. None of the devices apply and/or finish a viscous material along an adjoining surface or bead along a corner so as to efficiently and effectively produce uniform, clearly defined, continuous junctions of the applied surface and the adjoining surfaces, while simultaneously effecting all of the surfaces substantially free of any excess of the material being applied.

U.S. Patent 2,065,886 to Clift (1936) discloses a kitchen utensil for cleaning of bowls, pots and pans etc., i.e. particularly rounded surfaces which do not present defined corners.

U.S. Patent 3,744,079 to Krause (1973) discloses a tool that scrapes the excess caulk from an applied bead on an inside corner, but the working edges of the tool tend to catch on surfaces, and lack the ability to span adjacent tile grout joints or other deviations. Furthermore, when a third surface is encountered, the tool must be pushed up to the third surface, disrupting adjoining corner caulking beads.

U.S. Patent 3,761,992 to Schneller (1973), U.S. Patent 4,631,019 To House (1986) and U.S. Patent 4,784,598 to Kraig, Kenneth and Kasey Kranz (1988) disclose tools for coating both surfaces and rounding of an inside corner, but lack the ability to produce defined corner surface junctions.

U.S. Patent 3,846,060 to Otis (1974) discloses a troweling tool which has a blade which rides on both surfaces, displacing excess caulking outward onto both surfaces. The excess caulking must then be removed.

U.S. Patent 3,878,581 to Perna (1975) discloses a tool with which it is difficult to apply a uniform coating of much thickness at a corner due to the sensitivity to positioning of the tool by the craftsman. Only one face of the blade can be used in order to prevent the rubber from peeling away from the

rigid blade.

U.S. Patent 4,211,501 To Pedroso (1980) discloses a tool for inside corners. The tool does not have a definite pivot point to accomodate variances in the position in which the tool is held in relation to the adjoining surfaces. Therefore, it is difficult to effectively position this tool in a corner to prevent material from oozing around the tool onto the surfaces.

U.S. Patent 4,217,673 to Pearson (1980) discloses a tool for coating one side of an inside corner at a time, but does not effect a clean adjoining surface.

U.S. Patent 4,654,919 to Liberman (1987) discloses a broad knife with resilient sheet material extending beyond the forward edge of a flat, rigid blade, but has rigid nonworking side edges.

U.S. Patent 4,669,970 to Perry (1988) discloses tools for finishing radius corners, which have a rubber sheet extending beyond the forward edge of a backing plate, but lack the ability to produce continuous defined corner junctions.

Objects and Advantages

Accordingly, besides the objects and advantages of the adjoining surface device and methods described in my above patent, several objects and advantages of the present invention are:

(a) to provide a device for applying and finishing viscous materials along at least one adjoining surface which is easy to use, and efficient in effectively producing a uniform, clearly defined junction of the applied surface and the adjoining surface, while simultaneously all of the surfaces are effected substantially free of any excess of the material being applied;

(b) to provide a device that reduces a two step operation for each application of material to a one step operation, by effecting an adjoining surface substantially free of any excess viscous material, while simultaneously applying and/or finishing viscous material along the same

adjoining surface, thereby, eliminating the time and costly labor required to remove excess material;

(c) to provide a device which permits even the less skilled and less proficient craftsman to produce a high quality finished product without the tedious, laborious, time consuming, and costly reworking of the applied surface of material, in both the first and second steps of the operation, as required in the use of the prior art devices;

(d) to provide a device which reduces the risk of carpal tunnel syndrome and other physical disorders related to prolonged repetitive motion and pressure, by substantially reducing the work required to produce a high quality, continuous applied surface of viscous material along at least one adjoining surface;

(e) to provide a device that, while in use, is feasible for a craftsman to continuously hold in position to substantially clean the adjoining surface of viscous material being applied, while simultaneously applying and finishing the material along the same adjoining surface;

Still further objects and advantages will become apparent from a consideration of the ensuing descriptions and drawings.

Drawing Figures.

In the drawings, closely related figures have the same number, but different alphabetical suffixes.

Figs. 1A to 1F show various aspects of an adjoining surface device in the form of a hand tool, that resembles a drywall taping knife supplied with flexible operative side extensions affixed to the blade.

Figs. 2A to 2C show a similar tool that resembles a drywall broad knife.

Fig. 3 shows a similar tool that resembles a cement or plaster trowel.

Fig. 4 shows a similar tool that resembles a plastering and grouting float.

Fig. 5 shows a tool similar to the tool shown in figs 1A to 1F, with the operative extensions affixed to the side faces of the reinforcing portion.

Figs. 6A and 6B show a similar tool formed of moldable material having a

plurality of thicknesses for controlled flexing.

Fig. 7 shows a tool similar to the tools shown in Figs. 1 to 6, configured for forming a bead of viscous material along a corner, and shows the manner of using the tool 190.

Fig. 8 shows a tool similar to the tool shown in Figs. 1A to 1F, with operative extensions of tapered cross section.

Fig. 9 shows a similar tool, with operative extensions having curved working edges.

Figs. 10A and 10B show a similar tool, with operative extensions having lipped working edges.

Figs. 11 to 13 show various dispositions of at least one flexible sheet and at least one reinforcing portion.

Fig. 14 shows a tool similar to the tool shown in Fig. 5, with indented side terminations of the reinforcing portion.

Fig. 15 shows a similar replacement operative extension and reinforcing portion assembly, with a forward edge having a plurality of notches.

Fig. 16 shows a similar tool, with a reinforcing portion and handle formed as one unit.

Fig. 17 shows a similar tool, with operative extensions affixed to replacable support plates which are interconnected with a reinforcing portion that is similar to the reinforcing portion of the tool shown in Figs. 1C, and 1D.

Fig. [14] 18 shows the manner of using the tool 20.

Fig. [15] 19 shows the manner of using the tool 134.

Reference Numerals In Drawings

In the drawings, similar parts have the same reference number, but different alphabetical suffixes. The suffixes: R = Right, L = Left

Figs. 1A to 1F

| | |
|-----|--|
| 20 | tool 20 |
| 22 | center line |
| 24 | reinforcing portion |
| 24A | forward region of portion 24 |
| 24B | rearward extending segment of portion 24 |
| 26 | forward edge of portion 24 |

| | |
|----------|--|
| 28A, 28B | handle halves |
| 30, 32 | flexible sheets |
| 34R, 34L | operative extensions |
| 36, 38 | forward edge of sheets 30, 32 |
| 40R, 40L | side edges of portion 24 |
| 42R, 42L | forward corners of portion 24 |
| 44R, 44L | angles of side edges to forward edge of portion 24 |
| 46R, 46L | aft side edges of portion 24 |
| 48R, 48L | side segments cut off of portion 24 |
| 50A, 50B | major faces of portion 24 |
| 52R, 52L | side extension portions of sheet 30 |
| 54R, 54L | side extension portions of sheet 32 |
| 56R, 56L | side edges of sheet 30 |
| 58R, 58L | forward corners of sheet 30 |
| 60R, 60L | angles of side edges to forward edges of sheet 30 |
| 62R, 62L | aft side edges of sheet 30 |
| 64 | rear edge of sheet 30 |

Figs. 2A to 2C

| | |
|----------|-------------------------------|
| 66 | tool 66 |
| 68 | reinforcing portion |
| 70 | forward edge of portion 68 |
| 72R, 72L | side edges of portion 68 |
| 74 | rear edge of portion 68 |
| 76, 78 | flexible sheets |
| 80R, 80L | operative extensions |
| 82, 84 | forward edge of sheets 76, 78 |
| 86R, 86L | side edges of sheet 76 |
| 88 | rear edge of sheet 76 |
| 90 | rear edge support |
| 92A, 92B | forward edges of support 90 |
| 94 | rear edge of sheet 78 |
| 96 | handle |

Fig. 3

| | |
|-----|--------------------------|
| 98 | tool 98 |
| 100 | reinforcing portion |
| 102 | back face of portion 100 |

104 forward edge of portion 100
106 rear edge of portion 100
108 stud type fasteners
110R, 110L operative extensions
112R, 112L forward edges of extensions 110R, 110L
114R, 114L rear edge of extensions 110R, 110L
116R, 116L outwardly facing edge of extensions 110R, 110L
118R, 118L inwardly facing edge of extensions 110R, 110L
120R, 120L clamp plates
122R, 122L forward edges of plates 120R, 120L
124R, 124L rear edges of plates 120R, 120L
126R, 126L inwardly facing edges of plates 120R, 120L
128R, 128L outwardly facing edges of plates 120R, 120L
130 nut type fasteners
132 handle

Fig. 4

134 tool 134
136 reinforcing portion
138 back face of portion 136
140 forward edge of portion 136
142R, 142L side edges of portion 136
144 rear edge of portion 136
146 flexible sheet
148 forward edge of sheet 146
150R, 150L side edges of sheet 146
152 rear edge of sheet 146
154R, 154L operative extensions
156 handle

Fig. 5

158 tool 158
160 reinforcing portion
162 forward edge
164 major face of portion 160
166R side face of portion 160
168 handle
170R, 170L operative extensions

172R, 172L major faces of extensions 170R, 170L
174L side face of extension 170L

Figs. 6A, 6B

176 tool 176
178 reinforcing portion
180 forward edge
182R, 182L operative extension portions
184 handle portion
186R, 186L rear corners of extension portions 182R, 182L
188 major face

Fig. 7 operation of tool 190

190 tool 190
192 reinforcing portion
194 forward edge
196R, 196L side terminations of portion 192
198R, 198L operative extensions
200R, 200L side edges of extensions 198R, 198L
202 handle

Fig. 8

204 tool 204
206 reinforcing portion
208 handle
210 flexible sheet
212R, 212L operative extensions
214 forward edge of portion 206
216 forward edge of sheet 210
218 tapered section of sheet 210
220 nontapered section of sheet 210
222R, 222L side corners of extensions 212R, 212L

Fig. 9

224 tool 224
226 reinforcing portion
228 handle
230 flexible sheet

232R, 232L operative extensions
234R, 234L side edges of extensions 232R, 232L
236R, 236L aft side edges of extensions 232R, 232L
238R, 238L rounded side corners
240 forward edge

Figs. 10A, 10B

242 tool 242
244 reinforcing portion
246 handle
248 flexible sheet
250R, 250L operative extensions
252A, 252B lipped side edges of extension 250R
254A, 254B lipped side edges of extension 250L
256R, major face of extension 250R,

Fig. 11

258 device 258
260 flexible sheet
262 reinforcing portion
264R, 264L sheet segments

Fig. 12

266 device 266
268R, 268L flexible sheet segments
270R, 270L flexible sheet segments
272 reinforcing portion

Fig. 13

274 device 274
276 flexible sheet
278A, 278B reinforcing portions

Fig. 14

280 tool 280
282 reinforcing portion
284R, 284L side terminations of portion 282
286R, 286L operative extensions

| | |
|-------------------|---|
| <u>288</u> | <u>handle</u> |
| <u>290</u> | <u>forward edge of portion 282</u> |
| <u>292R, 292L</u> | <u>forward corners of portion 282</u> |
| <u>294R, 294L</u> | <u>side edge of extensions 286R, 286L</u> |
| <u>296</u> | <u>forward edge of handle 288</u> |
| <u>298</u> | <u>slot along edge 296</u> |
| <u>300</u> | <u>fasteners in handle 288</u> |
| <u>302</u> | <u>rear edge of portion 282</u> |
| <u>304</u> | <u>slotted openings in edge 302</u> |

Fig. 15

| | |
|------------|---|
| <u>306</u> | <u>reinforcing portion and extension assembly 306</u> |
| <u>308</u> | <u>forward edge of assembly 306</u> |
| <u>310</u> | <u>notches in edge 308</u> |
| <u>312</u> | <u>teeth defined by notches 310</u> |

Fig. 16

| | |
|-------------------|----------------------------------|
| <u>314</u> | <u>tool 314</u> |
| <u>316</u> | <u>reinforcing portion</u> |
| <u>318</u> | <u>handle portion</u> |
| <u>320</u> | <u>additional handle portion</u> |
| <u>322R, 322L</u> | <u>operative extensions</u> |

Fig. 17

| | |
|-------------------|--|
| <u>324</u> | <u>tool 324</u> |
| <u>326</u> | <u>reinforcing portion</u> |
| <u>328</u> | <u>handle</u> |
| <u>330</u> | <u>fasteners</u> |
| <u>332R, 332L</u> | <u>support plates</u> |
| <u>334R, 334L</u> | <u>operative extensions</u> |
| <u>336</u> | <u>major face of portion 326</u> |
| <u>338</u> | <u>forward edge of portion 326</u> |
| <u>340R, 340L</u> | <u>forward corners of portion 326</u> |
| <u>342R, 342L</u> | <u>side edges of portion 326</u> |
| <u>344R, 344L</u> | <u>inwardly facing side edges of plates 332R, 332L</u> |
| <u>346R, 346L</u> | <u>side terminations of plates 332R, 332L</u> |
| <u>348R, 348L</u> | <u>forward edges of plates 332R, 332L</u> |
| <u>350R, 350L</u> | <u>rear edges of plates 332R, 332L</u> |

A typical embodiment of the adjoining surface device of the present invention is illustrated in Fig. 1A (isometric view), Fig. 1B (top plan view), Fig. 1C (top plan view of reinforcing portion with handle), Fig. 1D (exploded side view), Fig. 1E (side view), and Fig. 1F (end view). It will be observed that a hand tool is generally indicated by numeral 20. Referring first to Fig. 1A, the tool 20 consists of three principal elements, which are generally symmetrical about a common fore and aft center line 22 (Fig. 1B, top plan view). A thin, flat, semirigid reinforcing blade portion 24 (best shown in Fig. 1C, top plan view of reinforcing portion with handle) for added structural integrity, consists of flexible sheet like material that, when repeatedly flexed and released, returns to the original shape without cracking. As shown in Fig. 1A, the reinforcing portion 24 has a straight forward working edge 26 and a rearwardly extending segment 24B. Affixed to the segment 24B of the reinforcing portion 24 is a handle with two handle halves 28A, 28B (the second principal element), that serves as a means of applying a controlled directional force to the device. The reinforcing portion 24 is laminated between two identical resilient flexible sheets 30, 32 (the third principal element). Furthermore, the sheets 30, 32 extend symmetrically sidewardly beyond the corresponding terminations of the reinforcing portion 24, and are laminated to each other to create two flexible resilient operative extension side wiper blades 34R, 34L. The two flexible sheets 30, 32 each have a straight forward working edge 36, 38. The forward edges 36, 38 of the sheets 30, 32 are more or less coterminus with the corresponding forward edge 26 of the reinforcing portion 24.

Referring now to Fig. 1C (top plan view of the reinforcing portion with handle), the reinforcing portion 24 has two straight side edges 40R, 40L which terminate at forward corners 42R, 42L, with the forward edge 26 forming acute angles 44R, 44L; two straight aft side edges 46R, 46L and the rearwardly extending segment 24B (which is out of view, but shown in Fig. 1D exploded side view). For example, a 6 inch wide steel drywall taping knife has the semirigid reinforcing blade portion 24 with the handle halves 28A, 28B (28B out of view) affixed. The reinforcing portion 24 has two side segments 48R, 48L, which have been cut off at the angles 44R, 44L of 50 to 85 degrees to the forward working edge 26, making the side edges 40R, 40L, which are 2 to 5 inches in length. There are many tools of a suitable size shape, and material readily available which can be modified in this manner, such as a 6 inch steelhead taping knife model No. 526 available from Warner R Tool

Manufacturing Co. of Minneapolis, Minnesota. However, the reinforcing portion 24 can consist of any other material which has sufficient structural integrity for a forward working edge, and to support the operative side extensions 34R, 34L (shown in Fig. 1A); such as cold rolled steel, hot rolled steel, stainless steel, brass, aluminum, polyethelene, polystyrene, polyvinyl chloride, nylon, various impregnated or laminated fibrous materials, various plasticized materials, other polymers or any other plastics, various types of wood, etc. In other embodiments, the forward edge 26 of the reinforcing portion 24 may be any length, for instance from 0.250 inch to 12 inches, and in any shape suitable for the job. Also the length of the side edges 40R, 40L can be any length, say 0.250 inch to 8 inches, and be in any shape that effectively supports the operative extensions 34R, 34L. Furthermore, the angles 44R, 44L of the side edges 40R, 40L to the forward edge 26 of the reinforcing portion 24 may be any angle that provides a significant line of support for the operative side extensions 34R, 34L (Fig. 1A), in order to effectively produce the desired results. The forward corners 42R, 42L of the reinforcing portion 24 are slightly rounded each having a radius of 0.010 inch to 0.025 inch. However, in other embodiments the forward corners 42R, 42L may have no radius or any size of radius such as a radius of 0.002 inch. to 6 inches, and be of any given shape in order to achieve the desired configuration of the corner being formed.

As shown in Fig. 1D, the reinforcing portion 24 has identical, generally opposed major faces 50A, 50B, and is of tapered cross section, which varies from a minimum thickness of 0.005 inch to 0.050 inch at a forward region 24A, to an enlarged maximum thickness of 0.010 inch to 0.150 inch at about the rearwardly extending segment 24B. Transversely, (in Fig. 1C) the reinforcing portion 24 is of consistent thickness from side to side, perpendicular to the center line 22. The tapered cross section of the reinforcing portion 24 compensates for the inconsistent width of the portion 24, which enables the portion 24 to flex as desired, mainly in the forward region 24A, when pressed against a work surface. In other embodiments, the reinforcing portion 24 may be of consistent cross section and/or any suitable plurality of thicknesses.

Affixed to the rearwardly extending segment 24B of the reinforcing portion 24 are the two handle halves 28A, 28B. In other embodiments, the handle halves 28A, 28B may consist of any material that has sufficient stiffness, and/or may be of any construction, such as a one piece handle which slides

over the rearwardly extending segment 24B of the reinforcing portion 24. Overlaying both identical opposed major faces 50A, 50B of the reinforcing portion 24 are the two identical, resilient, flexible sheets 30, 32, which are preferably adhesively bonded directly to the reinforcing portion 24 as a three layer laminate (as shown in Fig. 1E, side view). As shown in Fig. 1F (end view), the sheets 30, 32 have two triangular side extension portions 52R, 52L and 54R, 54L, respectively, which are bonded to each other as two layer laminates, creating the operative extension side wiper blades 34R, 34L (as best shown in Fig. 1A). As shown in Fig. 1E, The forward edge 26 and the rearwardly extending segment 24B of the reinforcing portion 24 are, more or less, the only areas not covered with the sheets 30, 32.

As shown in Fig. 1B, the flexible sheet 32 and the reinforcing portion 24 are out of view. Being that the flexible sheets 30, 32 are essentially of the same shape and size, only the one sheet 30 is described. The forward edge 26, the side edges 40R, 40L, and the forward corners 42R, 42L of the reinforcing portion 24 are illustrated by broken phantom lines. The flexible sheet 30 is of consistent cross section and has two straight side edges 56R, 56L, which are 1 to 3 inches in length; the side edges 56R, 56L and the forward edge 36 terminate at forward corners 58R, 58L forming obtuse angles 60R, 60L of 60 to 120 degrees; two straight aft side edges 62R, 62L and a rear edge 64 parallel to the forward edge 36. Triangular shaped side portions 52R, 52L of the sheet 30 extend sidewardly beyond the side working edges 40R, 40L (illustrated by broken phantom lines) of the reinforcing portion 24 (which is out of view). The forward working edge 36 of the sheet 30 extends slightly sidewardly beyond the forward corners 42R, 42L (illustrated by broken phantom lines) of the portion 24, from 0.050 inch to 0.150 inch. However, in other embodiments, the forward edge 36 of the sheet 30 may extend sidewardly any distance beyond the forward corners 42R, 42L of the portion 24, such as 0.001 inch to 2 inches. Or conversely, the reinforcing portion 24 may extend sidewardly beyond the forward corners 58R, 58L of the sheet 30 any distance, say 0.001 inch to 2 inches.

Furthermore, the forward edge 26 of the reinforcing portion 24 may extend forwardly, beyond the corresponding forward edge 36 of the sheet 30, any distance, say 0.002 inch to 2 inches for instance. Or conversely, the sheet 30 may extend forwardly beyond the forward edge 26 of the portion 24 any distance, such as 0.002 inch to 2 inches. The side edges 56R, 56L of the sheet 30 may be any length, say 0.250 inch to 6 inches, and any shape suitable for

the job. The angles 60R, 60L of the side edges 56R, 56L to the forward edge 36 of the sheet 30 may be any angle which is sufficient for the use of the device on corner surfaces which deviate considerably from being at right angles, i.e. any angle of two adjoining corner surfaces to be worked upon. Furthermore, the angle 60R may be different than angle 60L. For example, one side of the device to be used for 90 degree inside corners and the other side for 135 degree inside corners. The two forward corners 58R, 58L of the sheet 30 are slightly rounded each having a radius of 0.010 inch to 0.025 inch. However, in other embodiments, the corners 58R, 58L may have no radius, or any size radius, such as a radius of 0.002 inch to 6 inches, and may be of any given shape in order to achieve the desired configuration of the corner being formed.

The resilient sheets 30, 32, in the preferred embodiment tool 20, are of a pliable, flexible, and/or resilient material, such as neoprene sheet rubber, 30 to 90 durometer, 0.025 inch to 0.150 inch in thickness, and of consistent cross section, available from American Rubber & Supply Co. of Van Nuys, California. However, the sheets 30, 32 can consist of any other material that is sufficiently pliable, flexible, and/or resilient, such as natural rubber, synthetic rubber, silicone rubber, high carbon steel, spring steel, stainless steel, polystyrene, polyvinyl chloride, nylon, various impregnated or laminated fibrous materials, various plasticized materials, foam type materials, other polymers or any other plastics, etc., and may be of tapered cross section, or any other plurality of thicknesses sufficient for producing the desired results. The adhesive bonding the flexible sheets 30, 32 to each other and to the reinforcing portion 24 as a laminate, is a contact cement, e.g. Dap smooth spread contact cement available from American Rubber & Supply Co. of Van Nuys, California. However, the laminate interrelationship of the sheets 30, 32 to the reinforcing portion 24 and to each other can consist of any other material or means which affixes the sheets 30, 32 to the portion 24 and to each other, thereby, preventing peeling or otherwise separating, e.g., two part epoxy, other contact cements, silicone rubber adhesive, heat bonding, heat sensitive adhesive, pressure sensitive adhesive, double sided adhesive tape, clamping device, various fasteners, welding, soldering, etc.

Additional embodiments of the present invention are shown in Figs. 2 to 7. For exemplary purposes, the embodiments of the adjoining surface device shown in Figs. 2A to 2C, 3, and 4 are each in the form of a hand tool. Each tool has a thin, flat, reinforcing blade portion, generally of the same size and

isosceles trapezoidal shape, and is of consistent cross section; each has a straight forward working edge, the longest of the edges; two straight side edges at acute angles to the forward edge; and a straight rear edge parallel to the forward edge. The angles of the side edges to the forward edges of the reinforcing portion are from 50 to 85 degrees, the same as 44R, 44L of the embodiment tool 20, and the flexible sheets are from 60 to 120 degrees, the same as the angles 60R, 60L of the embodiment tool 20, previously mentioned and shown in Figs. 1B and 1C. Furthermore, the relationship of the forward corners of the reinforcing blade and the corresponding forward corners of the resilient sheets is generally the same as the forward corners 42R, 42L and 58R, 58L of the embodiment tool 20, previously discussed and illustrated in Figs. 1B and 1C. In each case, the device is generally wider than the tool 20, making the device most useful for working with larger areas. All of the embodiments consist of one or more of the materials described in the embodiment tool 20, and/or any other suitable material(s).

A first additional embodiment of the adjoining surface device of the present invention is illustrated in Fig. 2A (isometric view), Fig. 2B (top plan view of reinforcing portion with handle), and Fig. 2C (side view). It will be observed that a hand tool is generally indicated by numeral 66. Referring first to Fig. 2A, the tool 66 has a reinforcing blade portion 68 (which is mostly out of view, but shown in Fig. 2B) having a forward working edge 70, two side edges 72R, 72L (which are mostly out of view, but shown in Fig. 2B), and a rear edge 74. The reinforcing portion 68 is laminated between two identical, flexible sheets 76, 78. Furthermore, side extensions of the sheets 76, 78 are laminated to each other to create two operative extension wiper blades 80R, 80L. The two sheets 76, 78 are of the same size and isosceles trapezoidal shape and of the same consistent cross section, each having an identical forward edge 82, 84. Being that the two sheets are identical, only the one most visible sheet 76 is described here, having two side edges 86R, 86L and a rear edge 88 parallel to the forward edge 82. The forward edges 82, 84 of the sheets 76, 78 are more or less coterminous with the corresponding forward edge 70 of the reinforcing portion 68. Affixed to the length of the rear edge 74 of the reinforcing portion 68 is a U shaped support 90 (as best shown in Figs. 2B and 2C). The support 90 consists of a semirigid material such as steel or aluminum, having two forward edges 92A, 92B. The support 90 is of consistent cross section, say about 0.010 inch to 0.200 inch in thickness, which is formed into a U shape that is wrapped, crimped, and/or

otherwise affixed along the rear edge 74 (best shown in Figs. 2A and 2C) of the reinforcing portion 68. The support 90 provides additional structural integrity to the rear edge 74 of the portion 68, enabling the portion 68 to be of the desired flexibility, while being of substantial width. The rear edges 88, 94 of the flexible sheets 76, 78 butt up to the forward edges 92A, 92B of support 90. As best shown in Fig. 2A, the sheets 76, 78 extend sidewardly beyond the side edges 72R and 72L (72L is out of view, but shown in Fig. 2B) of the reinforcing portion 68, respectively. The laminar interrelationship of the flexible sheets 76, 78 and the reinforcing portion 68 is essentially the same as the preferred embodiment tool 20, previously described and shown in Figs. 1E and 1F. Also the operative extension wiper blades 80R, 80L are essentially the same as the operative extensions 34R, 34L of the tool 20 (shown in Fig. 1A), with the exception of not having aft side edges. Affixed to the support 90 is a handle 96 which extends generally rearwardly.

A second additional embodiment of the device of the present invention is illustrated in Fig. 3 (isometric view). It will be observed that a tool is generally indicated by numeral 98. As shown in Fig., 3 the tool 98 has a reinforcing blade portion 100 with a front face (which is out of view), an opposite back face 102, a forward edge 104, two side edges (out of view), and a rear edge 106. Slightly inward from each corner of the back face 102 of the reinforcing portion 100 is a stud type fastener 108, which is welded or otherwise affixed perpendicular to the face 102. Partially overlapping the back face 102 of the reinforcing portion 100, say about 0.500 inch to 1.5 inches, are two removable and replaceable operative extension flexible wiper blades 110R, 110L, having two holes (out of view) which correspond with the studs 108. The operative extensions 110R, 110L protrude sidewardly beyond the side terminations (out of view) of the reinforcing portion 100, respectively. The right and left extensions 110R, 110L are essentially the same, each of consistent cross section, from 0.025 inch to 0.150 inch in thickness having a forward edge 112R, 112L, a rear edge 114R, 114L parallel to the forward edge 112R, 112L, an outwardly facing side working edge 116R, 116L, and an inwardly facing side edge 118R, 118L. The forward edges 112R, 112L and the rear edges 114R, 114L are more or less coterminous with the corresponding forward edge 104 and the rear edge 106 of the reinforcing portion 100. The inwardly facing side edges 118R, 118L are more or less parallel to the corresponding side terminations (out of view) of the reinforcing portion 100. Clamping the operative extensions 110R, 110L to the back face 102 of the reinforcing

portion 100 are two clamp plates 120R, 120L of consistent cross section with a hole (out of view) more or less centered at each end corresponding to the location of the studs 108. Each clamp plate 120R, 120L has a forward edge 122R, 122L, a rear edge (only one is in view) 124R, an inwardly facing side edge 126R, 126L, and an outwardly facing side edge 128R, 128L. The forward edges 122R, 122L and the rear edges (in view) 124R of both of the clamp plates 120R, 120L more or less terminate at the corresponding forward edge 104 and the rear edge 106 of the reinforcing portion 100. The outwardly facing side edges 128R, 128L of the clamps 120R, 120L are more or less coterminus with the corresponding side edges (which are out of view) of the reinforcing portion 100. The inwardly facing edges 126R, 126L are more or less coterminous with the corresponding inwardly facing side edges 118R, 118L of the operative extensions 110R, 110L. Engaged on each stud 108 is a removable nut type fastener 130. The clamp plates 120R, 120L and the nuts 130 securely affix the operative extensions 110R, 110L to the reinforcing portion 100. There may be more than two studs and corresponding holes per clamp plate and operative extension. Furthermore, one or more of the holes may be elongated from front to back. There may be a second nut on each stud, locked tight against the first nut. The first nut is finger tight against the clamp plate. The finger tight nut, together with the elongated holes, allows the clamp plates to slide, enabling the reinforcing portion and the clamp plates to be flexed. At about the center of the back face 102 of the reinforcing portion 100 is a handle 132, affixed such as in the conventional manner of a cement or plastering trowel, which adds structural integrity to the portion 100.

A third additional embodiment of the device of the present invention is illustrated in Fig. 4 (isometric view). It will be observed that a tool is generally indicated by numeral 134. The tool 134 is shown having a reinforcing blade portion 136 with a front face (which is out of view), an opposite back face 138, a forward working edge 140, two side working edges 142R, 142L, and a rear edge 144. Completely overlaying the front face (which is out of view) of the reinforcing portion 136 is a flexible sheet 146 of consistent cross section, say about 0.100 inch to 0.750 inch in thickness, which may or may not be thicker than other embodiments. The sheet 146 has a forward working edge 148, two side working edges 150R, 150L, and a rear edge 152 parallel to the forward edge 148. The sheet 146 is adhesively bonded or otherwise affixed, as previously described (tool 20), to the reinforcing portion 136. As described above, the side working edges 150R, 150L of sheet 146 are at obtuse angles to

the forward edge 148. Therefore, the sheet 146 has an isosolecs trapezoidal shape, in the reverse manner of the reinforcing portion 136, thereby, creating two protruding operative extension wiper blades 154R, 154L, respectively. The forward edge 148 and the rear edge 152 of the sheet 146 are parallel to and extend beyond the corresponding edges 140, 144 of the reinforcing portion 136, a suitable distance for the job, such as 0.100 inch to 1 inch. The forward edge 148 is proportionally longer, say 0.200 inch to 2 inches, than the corresponding forward edge 140 of the reinforcing portion 136. At about the center of the back face 138 of the reinforcing portion 136 is a handle 156, affixed such as in the conventional manner of a cement, plastering, or grouting float, which adds structural integrity to the portion 136.

A fourth additional embodiment of the device of the present invention is illustrated in Fig. 5 (isometric exploded view). It will be observed that a tool is generally indicated by numeral 158. As shown in Fig. 5, the tool 158 consists of a reinforcing blade portion 160, which is similar to the reinforcing portion of tool 20, Fig. 1C (top plan view) and 1D (exploded side view), with the exception of being of increased tapered cross section. The reinforcing portion 160 has a forward edge 162, two generally opposed major faces (only one is in view) 164, two side faces (only one is in view) 166R, and a handle 168 is affixed. The portion 160 varies from a minimum thickness, of say 0.005 inch to 0.250 inch, at about the forward edge 162 to an enlarged maximum thickness, of say 0.015 inch to 0.500 inch, at about the handle 168. Affixed to the side faces (only one is in view) 166R of the reinforcing portion 160 are two protruding, operative extension wiper blades 170R, 170L. The operative side extensions 170R, 170L are more or less the same shape as the wiper blades of tool 20 Fig. 1A (isometric view), however, they are of the same corresponding cross section as the reinforcing portion 160. The operative extensions 170R, 170L each have two generally opposed major faces (only one of each is in view) 172R, 172L and an inwardly facing side face (only one is in view) 174L. The side faces 174L (right face is out of view) of the operative extensions 170R, 170L butt against and are affixed to the corresponding side faces, 166R (Left face is out of view), of the reinforcing portion 160. The opposed major faces 164 (in view) of the reinforcing portion 160 are more or less in the same plane, and flush with the corresponding opposed major faces 172R, 172L (in view) of the operative extensions 170R, 170L. The interrelationship of the reinforcing portion 160 side termination and the operative extensions 170R, 170L may be any suitable means of affixing them to

each other. For example, interlocking tongue and groove type connections for replaceable operative extensions, which may also be permanently affixed. The reinforcing blade portion 160 and the operative extension blades 170R, 170L may be molded by injection or otherwise formed, then affixed to each other by means of adhesive, ultrasonic welding, heat welding, etc. The handle 168, for example, may either be a separate part molded to the reinforcing portion 160, or may be molded as part of the portion 160 of the same material, as one unit.

A fifth additional embodiment of the device of the present invention is illustrated in Fig. 6A (isometric view) and Fig. 6B (side view). It will be observed that a tool molded by injection, or otherwise formed, is generally indicated by numeral 176. As shown in Fig. 6A, the tool 176 consists of a plastic or other moldable material formed into one piece or unit, having a reinforcing center portion 178, a forward edge 180, two flexible operative extension side wiper blade portions 182R, 182L, and a rearwardly extending handle portion 184. The operative extension portions 182R, 182L protrude beyond the side terminations of the reinforcing portion 178. The operative extensions 182R, 182L are more or less the same shape as the side operative extensions of tool 20 Fig. 1A (isometric view), with the exception of being of tapered cross section. The reinforcing portion 178 is more or less the same shape as the reinforcing portion of tool 20 Fig. 1C (top plan view), with the exception of being of increased tapered cross section. The reinforcing portion 178 supports the side operative extensions 182R, 182L, and thus are interrelated in such a way as to provide a significant line of support, more or less along the side terminations of the thicker reinforcing portion 178. As shown in Figs. 6A and 6B, the reinforcing portion 178 is tapered from a minimum thickness, of about 0.005 inch to 0.250 inch, at about the forward edge 180 to an enlarged maximum thickness, of about 0.015 inch to 0.500 inch, at about the handle portion 184. The operative extensions 182R, 182L are tapered from a minimum thickness, of about 0.002 inch to 0.100 inch., at about the forward edge 180 to an enlarged maximum thickness, of about 0.020 inch to 0.300 inch, at about rear corners 186R, 186L of the extensions 182R, 182L. The cross sections of the reinforcing portion 178 and the operative extension portions 182R, 182L may be any plurality of thicknesses and be in any configuration in order to provide the stiffness, flexibility and/or spring action to produce the desired results. The reinforcing portion 178 is much thicker and stiffer than the operative extensions 182R, 182L, which are thin for flexibility. The reinforcing portion 178 and the operative extensions

182R, 182L both vary in thickness for controlled overall flexure of the tool 176. The operative extensions 182R, 182L are flush, and more or less in one plane, with one of the major faces of the reinforcing portion 178 forming a single planar major face 188.

A sixth additional embodiment of the device of the present invention is illustrated in Fig. 7 (perspective operational view). It will be observed that an inside corner bead forming tool, for caulking or the like, is generally indicated by numeral 190. As shown in Fig. 7, the tool 190 consists of a reinforcing center portion 192, a forward edge 194, two side terminations 196R, 196L of the reinforcing portion 192, two flexible operative extension side wiper blade portions 198R, 198L protruding beyond the side terminations 196R, 196L, two side working edges 200R, 200L of the operative extension portions 198R, 198L, and a rearwardly extending handle portion 202.

The tool 190 is more or less the same as tool 20, with the exception of the angles of the side terminations 196R, 196L of the reinforcing portion 192 to the forward edge 194 having angles of 85 to 130 degrees, and the side edges 200R, 200L of the operative extensions 198R, 198L to the forward edge 194 having angles of 95 to 165 degrees. Therefore, the side edges 200R, 200L are at angles of 10 to 150 degrees to each other. Furthermore the forward edge 194 is substantially shorter than the forward edge of tool 20, say from 0.100 inch to 1 inch in length. The forward edge 194 is not necessarily straight, e.g. may have any size radius or other shape in order to form the viscous material into a bead or other desired configuration.

Variant embodiments of the present invention are shown in Figs. 8, 9, 10A and 10B. For exemplary purposes, in each case, the adjoining surface device is essentially the same as the first embodiment tool 20, previously discussed and illustrated in Figs. 1A to 1F, with the exception of the variants hereafter disclosed. In each case, the tool is illustrated with one of the two identical flexible sheets mostly out of view, therefore, only the most visible sheet is described.

A first variant embodiment of the present invention is illustrated in Fig. 8 (isometric view). It will be observed that a tool is generally indicated by numeral 204. Referring to Fig. 8, the tool 204 consists of a reinforcing blade portion 206 (which is mostly out of view), a handle 208, one flexible sheet 210 most visible, and two side operative extension blades 212R, 212L. The

reinforcing portion 206 has an exposed forward edge 214. The most visible flexible sheet 210 has a forward edge 216, a tapered section 218, and a flat nontapered section 220. The operative extensions 212R, 212L each have an outwardly facing side corner 222R, 222L. The tapered section 218 is from a minimum thickness, of about 0.002 inch to 0.100 inch, at about the forward edge 216 to an enlarged maximum thickness at about the side corners 222R, 222L consistently across the full width of the sheet 210, in one plane. The area of the tapered portion 218 in conjunction with the area of the nontapered section 220, which form the operative extensions 212R, 212L, helps balance the width to thickness ratio of the extensions 212R, 212L, aiding in more uniform flexibility, thereby, balancing the contact pressure between the working side edges of the operative extension blades 212R, 212L and the adjoining surface. Furthermore, the forward edge 214 of the reinforcing portion 206 is exposed, providing a more durable and stiffer forward working edge.

A second variant embodiment of the present invention is illustrated in Fig. 9 (isometric view). It will be observed that a hand tool is generally indicated by numeral 224. Referring to Fig. 9, the tool 224 consists of a reinforcing blade portion 226 (which is mostly out of view), a handle 228, one flexible sheet 230 most visible, and two side operative extension blades 232R, 232L. The side operative extensions 232R, 232L each have a side edge 234R, 234L, an aft side edge 236R, 236L and a rounded corner edge 238R, 238L therebetween. When the side edges 234R, 234L and the radiused peripheral corner edges 238R, 238L are urged against the adjoining surface not to be coated, a curved point of contact is produced. The curved point of contact tends to draw the viscous material from the side corners 238R, 238L toward the forward edge 240, where the material is formed into the applied surface. The rounded corners 238R, 238L each have a radius from 0.250 inch to 2 inches. However the corners 238R, 238L may have any size radius and be of any shape in order to effectively produce the desired results.

A third variant embodiment of the present invention is illustrated in Figs. 10A (isometric view) and 10B (partial end view). It will be observed that a hand tool is generally indicated by numeral 242. Referring to Fig. 10A, the tool 242 consists of a reinforcing blade portion 244 (which is mostly out of view), a handle 246, one flexible sheet 248 most visible, and two side operative extension blades 250R, 250L. The operative extensions 250R, 250L each have identical lips 252A, 252B and 254A, 254B which are rounded, in cross section, extending along the full length of the corresponding side edges of

the extensions 250R, 250L. As best shown in Fig. 10B, the rounded lip 252A has a radius from 0.010 inch to 0.100 inch, which protrudes beyond the plane of the corresponding major face 256R of the operative extension 250R. The rounded lips 252A, 252B and 254A, 254B, when urged against an adjoining surface not to be coated, produce a smaller and more consistent seal at the point contact, while the operative extensions 250R, 250L are in use and being flexed to various degrees. In addition, the smaller point of contact requires less force to produce a sealtight connection with the adjoining surface. The lips 252R, 252L may have any size radius and may be in any shape in order to effectively produce the desired results.

There are various possibilities with regard to the relative disposition of the resilient, and/or flexible sheets and the reinforcing blade portion which are laminated, fastened, bonded, fitted, or otherwise interrelated. For example, as illustrated in Figs. 11 to 13 (which present end views), Fig. 11 shows a device 258 with a flexible sheet 260 laminated to one face of a reinforcing blade portion 262, having two flexible sheet segments 264R, 264L, partially overlapping the opposite face of the reinforcing portion 262. Fig. 12 shows a device 266 with four flexible sheet segments 268R, 268L and 270R, 270L, which partially overlap both faces of a reinforcing blade portion 272, and Fig. 13 shows a device 274 with one flexible sheet 276 between two reinforcing blade portions 278A, 278B.

As discussed in the above description of the present invention, there are various possibilities with regard to the size, shape, and relative disposition of the reinforcing portion, flexible operative extensions, and the significant lines of support provided by the side terminations of the reinforcing portion for the operative extensions. For example, as illustrated in Figs. 14 to 17, Fig. 14 (isometric exploded view) shows a device in the form of a hand tool that is generally indicated by numeral 280. Tool 280 is similar to tool 158 Fig. 5 (isometric exploded view) with the exceptions of having a reinforcing portion 282 of consistent cross section with indented side terminations 284R, 284L, two flexible operative extensions 286R, 286L shaped to effectively interconnect with the corresponding supporting side terminations 284R, 284L, and a removable handle 288.

The reinforcing portion 282 has a straight forward edge 290 terminating at two forward corners 292R, 292L, which protrude sidewardly beyond the corresponding indented side terminations 284R, 284L. The flexible extensions

286R, 286L are more or less of the same corresponding cross section as the reinforcing portion 282. The configuration of the extensions 286R, 286L is the same generally triangular, somewhat wedge shape as discussed in the above description. Each extension 286R, 286L has an outwardly facing straight side edge 294R, 294L, terminating slightly rearward from the forward edge 290 of the portion 282, more or less at the corresponding protruding forward corners 292R, 292L. The forward corners 292R, 292L of the portion 282 provide pivot points for the forward edge 290 of the portion 282 and the corresponding side edges 294R, 294L of the extensions 286R, 286L. For example, when the working side edge 294R of the right flexible extension 286R and the corresponding right forward corner 292R of the reinforcing portion 282 are urged against an adjoining surface, the forward working edge 290 of the portion 282 is able to pivot at the forward corner 292R in relation to the adjoining surface. Simultaneously, the side edge 294R of the extension 286R automatically pivots at the same corresponding forward corner 292R of the portion 282, in relation to the adjoining surface and also in relation to the forward edge 290 of the portion 282. The forward corners 292R, 292L are illustrated being somewhat square but, as discussed in the description, the corners may be any desired size and shape, such as being rounded for forming viscous material into a rounded inside corner configuration. The shape of the extensions 286R, 286L and corresponding indented side terminations 284R, 284L may be any other desired configuration, such as somewhat rectangular shaped extensions. The cross section of the reinforcing portion and operative extension may be any thickness or plurality of thicknesses suitable for the job.

The removable handle 288 has a forward edge 296 perpendicular to the gripping portion, with a longitudinal slot 298 lying parallel to and along the length of the forward edge 296 within the thickness of the handle 288. Two screw type fasteners 300 are inserted into holes (which are out of view) perpendicular to the walls of the slot 298 to form posts (out of view), spaced apart within the slot 298. The reinforcing portion 282 has a rear edge 302 parallel to its forward edge 290. The rear edge 302 has two slotted openings 304 located to accomodate the corresponding screw fasteners 300, when the rear edge 302 of the portion 282 is inserted into the slot 298 in the handle 288. The size and shape of the slot 298 is defined by the configuration of the rear edge 302 and associated region of the portion 282. The slotted openings 304 in the reinforcing portion 282 are configured so as to be able to snap onto the corresponding fasteners 300 in the handle 288. The fasteners 300 in the handle 288 are then tightened, effectively clamping the reinforcing portion 282.

However, affixing the handle and the reinforcing portion to each other may be by any suitable means of affixture, such as: one or more releasable snap or locking means; snap-engagement means; one or more locking posts or other structures in the slot within the handle that, when depressed or twisted, have a smaller diameter or other dimension in the region of contact with the reinforcing portion, which releases the reinforcing portion; a longitudinal interlocking bead and associated slot or dove tail type connection lying parallel to the forward edge of the reinforcing portion, that may be disconnected by sliding the handle and reinforcing portion apart sidwady, which may include a locking or snap-engagement means means; etc. The reinforcing portion and operative extension assembly is interchangeable with many other useful configurations, such as a semirigid blade portion with a straight forward working edge and without flexible operative extensions; a blade having a notched forward edge and without flexible extensions; various sizes and shapes of the above and other configurations; etc.

The flexible extensions 286R, 286L consist of neoprene rubber and the reinforcing portion 282 consists of a polycarbonate or a high impact polystyrene. The extensions 286R, 286L and the reinforcing portion 282 are affixed to each other with cyanoacrylate type adhesive, in more or less the same manner as described in the description of tool 158 Fig. 5. The reinforcing portion 282 and the flexible extensions 286R, 286L may consist of any one or more suitable materials and may utilize any other means of affixing or interrelating them to each other, as discussed in the above description. For example, the reinforcing portion may be molded, while simultaineously being welded or fused to preformed flexible extensions or vise versa. The materal being molded to the first formed material may be heated to a molten fluid consistency at an adequate temperature to be molded and partially melt the associated first formed material. When the two materials cool a durable welded or fused connection of the two materials is effected. There are many materials suitable for this forming and welding or fusing prcess such as a reinforcing portion consisting of a polypropylene and flexible extensions consisting of a dynamically vulcanized blend of polypropylene and EPDM rubber e.g. hercuprene thermoplastic elastomer, availible from J-Von, Incorporated of Leominster, Massachusetts. Many other materials are suitable for this manufacturing process, such as: various plastic alloys; plastic rubber alloys; polycarbonate alloys; other alloyed materials; block copolymers; random copolymers; and other copolymers; homopolymers; other plastics; thermoplastic elastomers; other elastomers; dynamically vulcanized blends of polycarbonate,

other various polymers, plastics, or other materials with various types of rubber, thermoplastic elastomers, or other materials; etc. Further examples of a means of interrelating the reinforcing portion and the operative extensions are molecular cohesion, molecular bonding or fusion, interfusion etc.

The forward working edge of the reinforcing portion may be any size and shape, as discussed in the above description, and the reinforcing portion is replaceable with various other configurations. For example, as illustrated in Fig. 15 (isometric view). Fig. 15 shows a reinforcing portion and operative extension assembly 306 that is similar to the reinforcing portion and operative extensions of tool 280 Fig. 14, with the exception of having a straight forward working edge 308 provided with a plurality of notches 310 regularly spaced along its length. This type of forward edge configuration is commonly used for spreading thinset tile adhesives, plaster, or other viscous materials. When the assembly 306 is used to spread a viscous material strips of the material can pass between adjacent teeth 312 defined by the adjacent notches 310 acting in effect as metering recesses to control the amount of material being spread onto the work surface by organizing the material into strips of predetermined cross-sectional size and shape. The notches and adjacent teeth may be any desired shape and size suitable for the job.

The handle and reinforcing portion may be permanently affixed to each other, formed as one unit, etc., as discussed in the above description. For example, as illustrated in Fig. 16 (isometric view). Fig. 16 shows a tool 314 that is similar to tool 280 Fig. 14, with the exception of having a sheet like reinforcing portion 316 and handle portion 318 formed as one unit which is of consistent cross section, and an additional sheet like handle portion 320 laminated to the handle portion 318. The additional handle portion 320 is generally the same shape as the removeable handle of tool 280 Fig. 14. The side and rear edges of the additional handle portion 320 are more or less coterminous with the corresponding edges of the handle portion 318. Affixed to the reinforcing portion 316 are two operative extensions 322R, 322L, which are essentially the same as the operative extensions of tool 280 Fig. 14. The means of interrelating the extensions 322R, 322L with the reinforcing portion 316 is generally the same as the means of interrelating the operative extensions with the reinforcing portion of tool 280 Fig. 14. Tool 314 may be constructed of consistent cross section without the additional handle portion 320, or with an additional handle portion laminated to each of the two major faces of the handle portion 318.

The present invention may include a semirigid and/or resiliently flexible

strip, channel, other elongated member, or other shaped member affixed along the forward working edge of the reinforcing portion. The member may extend to each of the two forward corners or may terminate inward of the two corners. The member may be affixed in a manner to provide a more durable forward edge and/or forward corners. The member may also extend sidewardly beyond the reinforcing portion to form the sidewardly protruding forward corners, and may be affixed to a corresponding portion of the operative extensions. The forward corners may include or consist of a wear resistant section or insert to provide an outer pivot point when the device is in use.

The present invention may include and/or be interrelated with any combination and variations of the features, elements, and configurations disclosed herein. For example, as illustrated in Fig. 17 (isometric partially exploded view). Fig. 17 shows a tool 324 having a reinforcing portion 326 with a handle 328 affixed, four fasteners 330 affixed to the portion 326, two removeable semirigid support plates 332R, 332L configured to interconnect with the corresponding fasteners 330, and two flexible operative extensions 334R, 334L affixed to the corresponding support plates 332R, 332L.

The reinforcing portion 326 and handle 328 are similar to the reinforcing portion and handle of tool 20 Fig. 1C (top plan view of reinforcing portion with handle), and Fig. 1D (exploded side view) with the exception of the four fasteners 330. The reinforcing portion 326 has a major face 336 (the one face in view), a forward edge 338, two forward corners 340R, 340L, and two side edges 342R, 342L. The left side edge 342L is out of view, therefore, is illustrated in broken phantom lines. The fasteners 330 consist of a somewhat rigid material, each having a somewhat cylindrical shaft configuration with an enlarged flat head disposed at one end. The end of the shaft, opposite the head of each fastener 330, is welded or otherwise affixed to the major face 336 of the reinforcing portion 326, with the length of the shaft generally perpendicular to the face 336. One fastener 330 is located slightly inward from each of the two forward corners 340R, 340L, and one spaced apart from each forward corner 340R, 340L and slightly inward from each of the two corresponding side edges 342R, 342L, respectively.

The two removeable support plates 332R, 332L are similar to the reinforcing portion of tool 280 Fig. 14 with respect to the cross section, the side terminations, the protruding forward corners, the parts of the forward edge closely associated with each of the corresponding forward corners, and the material of which they consist. Each support plate 332R, 332L has an inwardly facing edge 344R, 344L generally opposite an indented side termination 346R,

346L and extending from a forward edge 348R, 348L to a rear edge 350R, 350L. Along the inwardly facing edge 344R, 344L of each plate 332R, 332L are two slotted openings 352 located and configured to snap onto the corresponding shafts of the fasteners 330, and fit between the head of the fasteners 330 and the major face 336 of the reinforcing portion 326, as a snap-engagement means. The forward edges 348R, 348L of the plates 332R, 332L are more or less in line with the corresponding forward edge 338 of the reinforcing portion 326, and extend sidewardly beyond the associated side edges 342R, 342L of the portion 326. The side terminations 346R, 346L of the plates 332R, 332L extend slightly beyond the corresponding side edges 342R, 342L of the portion 326. The plates 332R, 332L each have a recessed area to accomodate the associated thickness and shape of the reinforcing portion 326, making the extension area of the plates 332R, 332L essentially flush with the major face (out of view) of the portion 326 that is opposite the fasteners 330. The rear slotted opening 352 in each plate 332R, 332L is slightly elongated from front to rear, enabling the rear of the plates 332R, 332L to slide somewhat independently from the rear fasteners 330 when the reinforcing portion 326 is being flexed. There may be more than two fasteners and associated slotted openings per support plate. The fasteners and associated slotted openings may be any effective means of affixture, such as one or more clips which can snap onto the reinforcing portion and snap onto the support plates and may also snap into holes in the reinforcing portion and/or notches in the support plates, support plates which snap directly onto the reinforcing portion, other snap-engagement means, screw or bolt type fasteners and corresponding holes in the plates, etc.

The two operative extensions 334R, 334L are essentially the same as the operative extensions of tool 280 Fig. 14. The means of interrelating the extensions 334R, 334L with the corresponding side terminations 346R, 346L of the removeable support plates 332R, 332L is generally the same as the means of interrelating the operative extensions with the reinforcing portion of tool 280 Fig. 14.

From the description above, a number of advantages of my adjoining surface devices become evident:

(a) A device with operative extension blades which are easily replaceable and interchangeable with various blades, thereby, easily adaptable to various angles, shapes, and textures of the adjoining surface.

(b) A hand tool which can be used in a manner similar to that of using a cement or plaster finishing trowel, which has the prior art advantage of the handle mounted on the major face of the reinforcing blade portion, and the novel features of the operative extension portions.

(c) A device having a reinforcing portion and at least one operative extension which are a plurality of thicknesses, in cross section, configured to provide optimal stiffness and flexibilities for controlled overall flexure and spring action of the device. Furthermore, the performance of the device is optimized by the plurality of thicknesses employed, which provide the most favorable size and shape of the working edges, and contact pressures of the edges against the adjoining surfaces and against the viscous material. The device is configured according to all the work parameters and conditions, providing optimum performance. The device is completely one piece or unit, whereby, the device is additionally simple and inexpensive to manufacture by means of injection molding or other type of forming.

(d) A device with lips, along the side edges of the operative extension blade, that produces a narrower and more consistent line of contact with the adjoining surface while the extension blade is in use and being flexed in various areas. The consistent narrow line of contact requires only a minimum amount of force, applied to the device by the craftsman, to produce a consistent viscoustight seal with the adjoining surface.

Operation-Figs. 7, [14] 18 and [15] 19

The manner of using the adjoining surface devices of the present invention to apply and finish viscous materials along an adjoining surfaces is similar, and in some situations identical, to that for some tools and other devices in present use, including some of those previously mentioned in the background section of this patent.

Tool 66 (Figs. 2A to 2C), and tool 280 (Fig. 14) [is] are used more or less in the same manner as tool 20 (Figs. 1A to 1F). For example, tool 20 is shown in Fig. [14] 18. In residential and commercial construction a sheet of drywall [280] 354 (work surface) is installed, which more or less butts against an

adjoining surface not to be coated [282] 356, forming an inside corner. If there happens to be a gap [284] 358 between the drywall edge and the adjoining surface [282] 356, the gap [284] 358 is bridged with a drywall joint tape [286] 360. The edge of the tape [286] 360 butts up to and conforms to the adjoining surface [282] 356, thereby, extending the plane of the drywall work surface [280] 354 to the adjoining surface [282] 356.

The craftsman first applies a bed coat of joint compound [288] 362 by drawing the tool 20 along the surfaces [280] 354, [282] 356 at the inside corner, in the direction indicated by arrow [290] 364. The tool 20 is positioned with the working face (which is out of view) of the blade basically at an acute angle to the drywall work surface [280] 354; with the joint compound sandwiched between the working face of the tool blade and the drywall work surface [280] 354; with the forward working edge 38 more or less against or skimming over the work surface [280] 354, and more or less at a right angle to the adjoining surface [282] 356; and having the resilient side edge 56L urged against the adjoining surface [282] 356 a sealtight connection is produced, while simultaneously forming the applied bed coat [288] 362 along the adjoining surface [282] 356.

The craftsman then lays the joint tape [286] 360 in the bed coat [288] 362 while it is still wet. While drawing the forward edge 38 of the tool 20 along the work surface [280] 354 imbedding the joint tape [286] 360, the air pockets and excess compound are squeezed out. The angle of the resilient side edge 56L to the forward edge 38 is variable and resilient. The variable angle automatically compensates for irregularities in the adjoining surface [282] 356, inconsistencies in the angle of the corner, and any significant deviation of the angle of the corner from being more or less a right angle, thereby, preventing the joint compound from oozing onto the adjoining surface [282] 356 and/or the applied bed coat [288] 362, and tape [286] 360. The tool 20 pivots at the forward corner 42L, while automatically maintaining the sealtight connection between the side edge 56L and the adjoining surface [282] 356. Therefore, the tool 20 is not sensitive to the exact positioning in relation to the adjoining surface [282] 356. The large area of contact of the resilient side edge 56L spans the irregularities in the adjoining guide surface [282] 356 and absorbs the shock of the irregular adjoining guide surface [282] 356, essentially eliminating blade chatter, which facilitates a smooth operation, thus, a smooth applied surface of the bed coat [288] 362. The craftsman lets

the bed coat [288] 362 dry and then, in the manner described above, forms an additional coat of joint compound [292] 366 into a smooth applied surface [294] 368 over the reinforcing joint tape [286] 360 and the bed coat [288] 362. During the drying process, the compound shrinks as the water evaporates from the compound, thereby, effecting irregularities in the applied surface [294] 368. Therefore, three to four applications of joint compound are usually required to achieve a smooth applied surface [294] 368. The resilient side edge 56L and the forward working edge 38 work together simultaneously, to effect a clearly defined, uniform, continuous junction [296] 370 of the smooth applied surface [294] 368 and the clean, unscathed adjoining surface [282] 356.

Tool 98 (Fig. 3) is used in more or less the same manner as tool 134 (Fig. 4). For example, tool 134 is shown in Fig. [15] 19. The manner of using the tool 134 is essentially the same as the description of the tool 20 Fig. [14] 18, with the exception of the way in which it is grasped due to the location of the handle 156. For example, as shown in Fig. [15] 19, the tool 134 is pulled along the adjoining surface [298] 372, forming an applied surface [300] 374 of viscous material being applied [302] 376, and worked in the direction indicated by arrow [304] 378. The side edge 150R of the operative extension is urged against the adjoining surface [298] 372, while simultaneously the forward working edge 148 forms the applied surface [300] 374. It is as easy to produce a clearly defined uniform junction [306] 380 of the applied surface [300] 374 and the adjoining surface [298] 372 as in the use of tool 20, described above and shown in Fig. [14] 18. It is usually desirable to have the handle 156 in the location illustrated in order to generate the force required to work with viscous materials of thicker consistency such as cement, plaster, tile grout, or other like materials.

The manner of using the tool 190 for finishing caulking, sealants, or other viscous materials along an inside corner is somewhat the same as the use of the tool 20, described above and shown in Fig. [14] 18. For example, as shown in Fig. 7, during original construction and/or repair work, interior and exterior inside corners are frequently encountered where there is an undesirable crack or seam [308] 382 between the two work surfaces [310] 384A, [310] 384B and/or irregularities at the corner. A bead of caulking [312] 386 is dispensed along the length of the corner by the use of a caulking gun or other means. Tool 190 is then placed directly into the corner of the two work

surfaces [310] 384A, [310] 384B, usually with the forward working edge 194 more or less at a third adjoining surface, e.g. two wall surfaces and a ceiling surface. The tool 190 is positioned at an acute angle of, say 30 to 60 degrees, to the corner being worked upon, and centered between the two surfaces [310] 384A, [310] 384B with the forward edge 194 spanning the corner, as the tool 190 voluntarily finds the center of the corner. Therefore, the forward working edge 194 consistently spans the corner, while simultaneously both of the operative extension blades 198R, 198L are urged against the work surfaces [310] 384A, [310] 384B. A sealtight connection is then produced between the side working edges 200R, 200L of the extension blades 198R, 198L and the adjoining surfaces [310] 384A, [310] 384B. The tool 190 is then pulled along the corner in the direction of the acute placement angle which is also indicated by arrow [314] 388. The dispensed bead of caulking [312] 386 is then formed into a continuous uniform bead [316] 390 along the corner by the forward working edge 194. The formed bead [316] 390 conceals the crack or seam [308] 382, and/or irregularities of the corner. In one pass, the tool 190 effectively produces clearly defined, continuous inside corners [318] 392A, [318] 392B of the smooth, uniform applied bead surface [316] 390 and the adjoining surfaces [310] 384A, [310] 384B. The adjoining surfaces [310] 384A, [310] 384B and the formed bead surface [316] 390 are substantially free of excess caulking, due to the continuous seal produced by the side working edges 200R, 200L of the operative extensions 198R, 198L, thereby, in one pass, a fine finished product is produced easily and efficiently.

Summary, Ramifications and Scope

All of the features disclosed and illustrated herein are examples of some of the configurations which are applicable to all of the adjoining surface devices of the present invention.

Accordingly, the reader will see that the adjoining surface device of this invention can be used easily and efficiently to effectively apply and/or finish viscous materials, along at least one adjoining surface to produce a uniform, clearly defined junction of the applied surface and the adjoining surface, while simultaneously effecting all of the surfaces substantially free of excess of the material being applied. The angle of the side edges to the forward edge of the device is variable, the operative extensions are flexible, and the forward working edge is somewhat rigid. Therefore, the

device provides a good forward edge for forming viscous materials, and operative extensions which, when urged against a surface, continuously produce a substantially sealtight connection. The angle of the forward edge to the side edges being variable and resilient, can automatically conform to irregularities in the angle of the corner and to the position in which the tool is being held, while a sidewardly force is maintained against the adjoining surface. The constant sideways force continuously maintains the seal between the side edge and the adjoining surface. The seal prevents the viscous material from oozing between the side edge of the tool and the adjoining surface, and from being deposited on the surfaces. The variable position in which the tool embodiment can be held enables a craftsman to readily apply his skill with greater perfection while the viscous material is being worked and/or formed into the applied surface, thereby, the desired results are produced easily and efficiently. The device can be used easily and efficiently to clean various containers. In addition, the product of substantially clean smooth surfaces greatly reduces, if not eliminates, an entire second operation after each application of material to scrape, sand, and clean up any excess material. Furthermore, the elimination of the second operation can have additional advantages in that

- . no cavities will be created from protrusions being scraped off;
- . no dried material will be cracked or broken out of voids;
- . no dried particles will contaminate the material being applied, which cause chatter marks and grooves;
- . dust will not have to be removed from the surfaces to provide the clean surfaces necessary for good adherence of the next application of material;
- . there are considerably fewer voids and chatter marks to fill in following each application;
- . no additional time and labor is spent on the second operation; and
- . the risk of carpal tunnel syndrome and other physical disorders related to prolonged repetitive motion and pressure is substantially reduced.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention, but as merely providing illustrations of some of the presently preferred embodiments of this invention. For example, the adjoining surface device can be of other configurations, such as

- . injection mold or other type of forming flexible material to one or both

sides of a reinforcing portion and forming flexible operative extensions;

- . a reinforcing portion fitted into a molded flexible portion, having operative extensions, being an interference fit, and/or bonded;

- . molded flexible material of one or more operative extension portions, which partially overlap one or both faces of a reinforcing portion;

- . operative extensions consisting of thin flexible sheet metal, which is welded or otherwise affixed to a reinforcing portion;

- . a handle that is offset from being at a right angle to a forward working edge and/or offset from being centered about the forward edge;

- . a reinforcing portion with only one operative extension.

- . the reinforcing portions and the operative extensions may be of any suitable plurality of thicknesses, tapered cross sections, and/or consistent cross sections; and

- . the handles may be any other means for applying a controlled directional force to the devices, in order to produce the desired results. For example, the means for applying a controlled directional force to the device may be a part of a machine, or apparatus, used for spreading viscous materials along an adjoining surface in the manufacture of materials, such as drywall sheets, cement blocks, cement curbs, moldable plastics, various lamination processes. As an example of one of the lamination processes, in the manufacturing process of laminate surfaces where a controlled layer or film of viscous material is spread along an adjoining surface, while simultaneously effecting an adjoining surface substantially free of excess material being applied and formed. The layer of material being formed butts against the adjoining surface, producing a clearly defined continuous junction of the surface being applied and the adjoining surface, easily and efficiently.

In addition to the above description the present invention can be used for working granular or powdered substances and/or food substances for consumption, etc.

Any embodiment of the present invention may be configured so as to include any combination of the features disclosed herein.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

Claims:

1. An article for working a substance along at least one surface, the article comprising:

- (a) a blade like member having an edge, and at least one at least partially flexible side extension flap;
- (b) integrating means for integrating the member and the side flap;
- (c) said side flap having an outer side which is angular to the edge; and
- (d) said side flap having a diminished extension distance in the proximity of the edge,

whereby, the article can be easily positioned and moved for working the substance along the surface while the flexible side flap can springably follow the surface, thus producing a dam effect so that the surface is effected substantially free of undesired excess of the substance.

2. The article as defined in claim 28 further comprising: two at least partially flexible side extension flaps with at least part of the blade like member therebetween;

integrating means for integrating the member and the two side flaps;

said side flaps each having an outer side which is angular to the edge; and

said side flaps each having a diminished extension distance in the proximity of the edge.

3. A device for working a substance along at least one surface, the device comprising:

- (a) a blade having an edge, and at least one side angular to the edge;
- (b) at least one damming means for substantially damming the substance from passing between at least part of the side and the surface;
- (c) at least one self-reextending means for springably and cooperatively reextending the damming means from the blade when the damming means is moved in relation to the edge and then released; and
- (d) integrating means for integrating the damming means with the blade in the proximity of the side,

whereby, the device can be easily positioned and moved for working the substance along the surface while the damming means can springably follow the surface, thus producing a dam effect so that the surface is effected substantially free of undesired excess of the substance.

4. The device as defined in claim 30: wherein the blade having two sides angular to the edge; comprising
- two damming means for substantially damming the substance from passing between at least part of at least one of the two corresponding sides and the surface;
- at least one self-reextending means for springably and cooperatively reextending each of the two damming means from the blade when the damming means are moved in relation to the edge and then released, and
- integrating means for integrating each of the two damming means with the blade in the proximity of the each of the two corresponding sides.

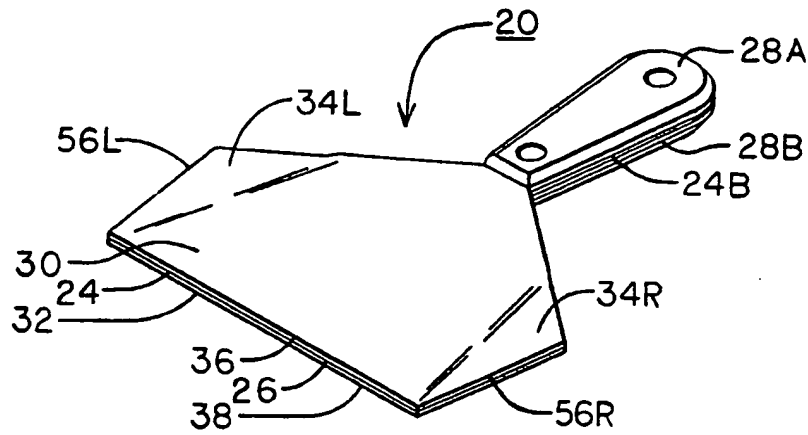


Fig. 1A

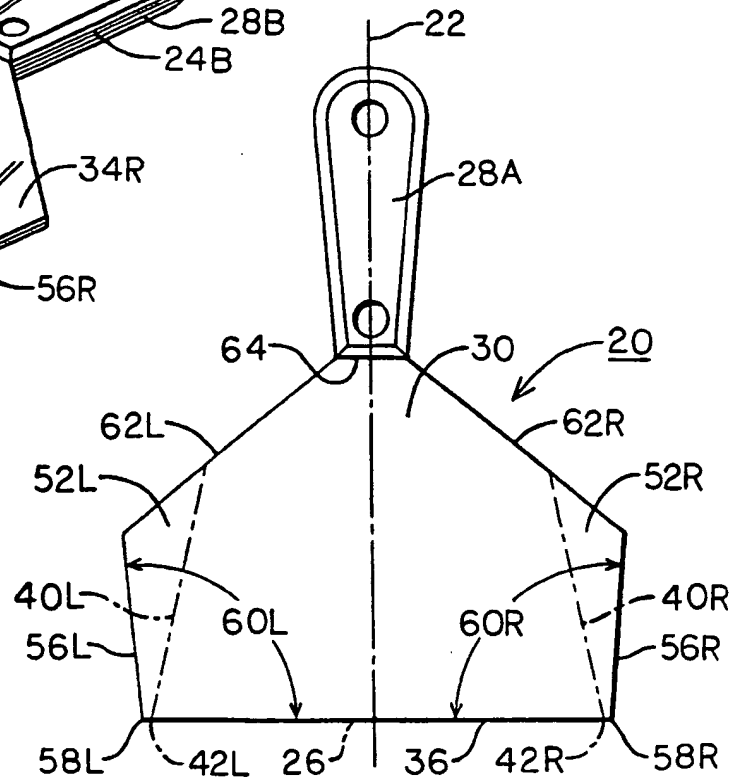


Fig. 1B

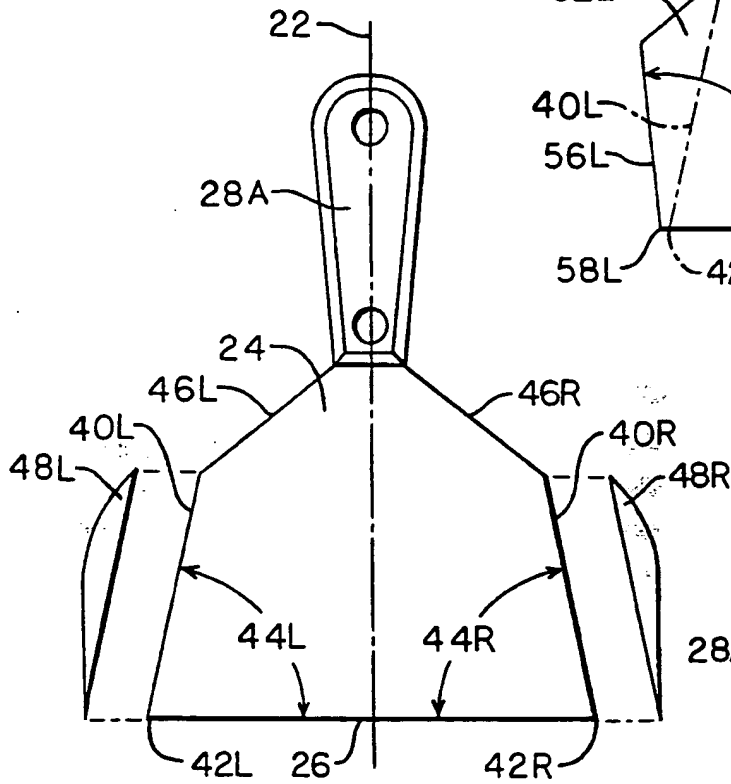


Fig. 1C

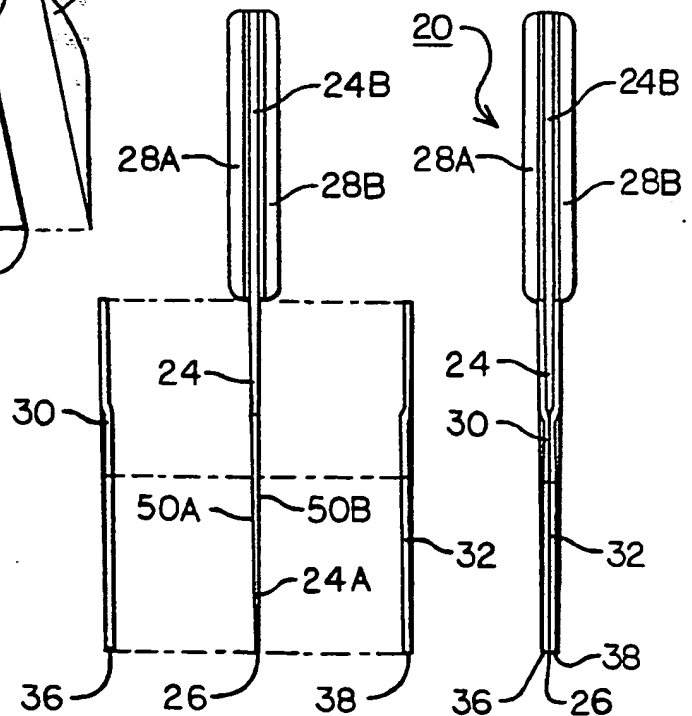


Fig. 1D

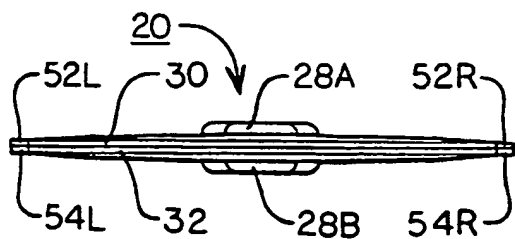


Fig. 1E

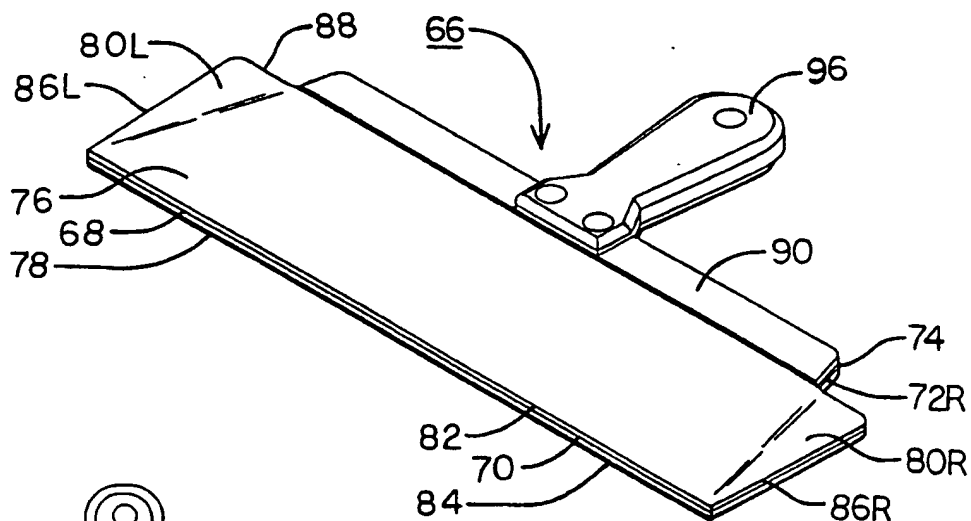


Fig. 2A

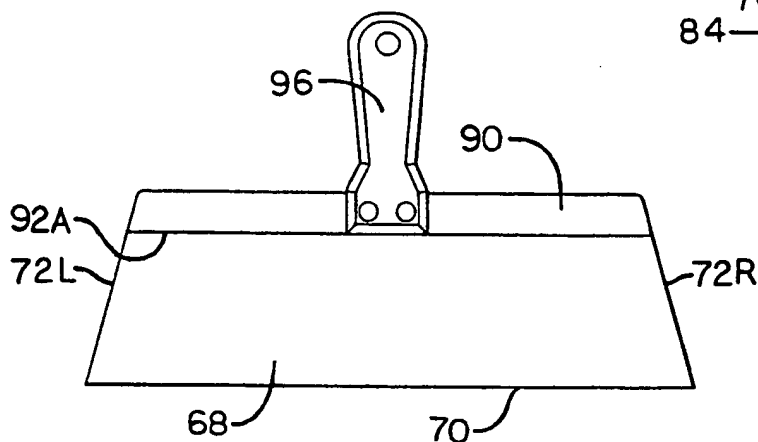


Fig. 2B

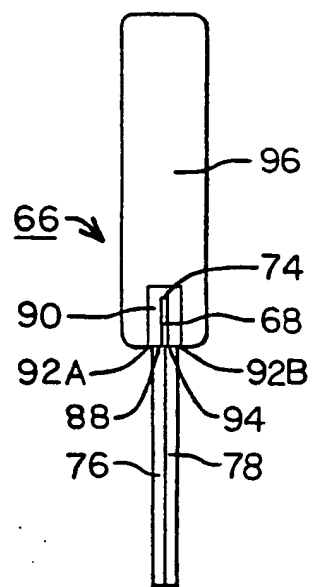


Fig. 2C

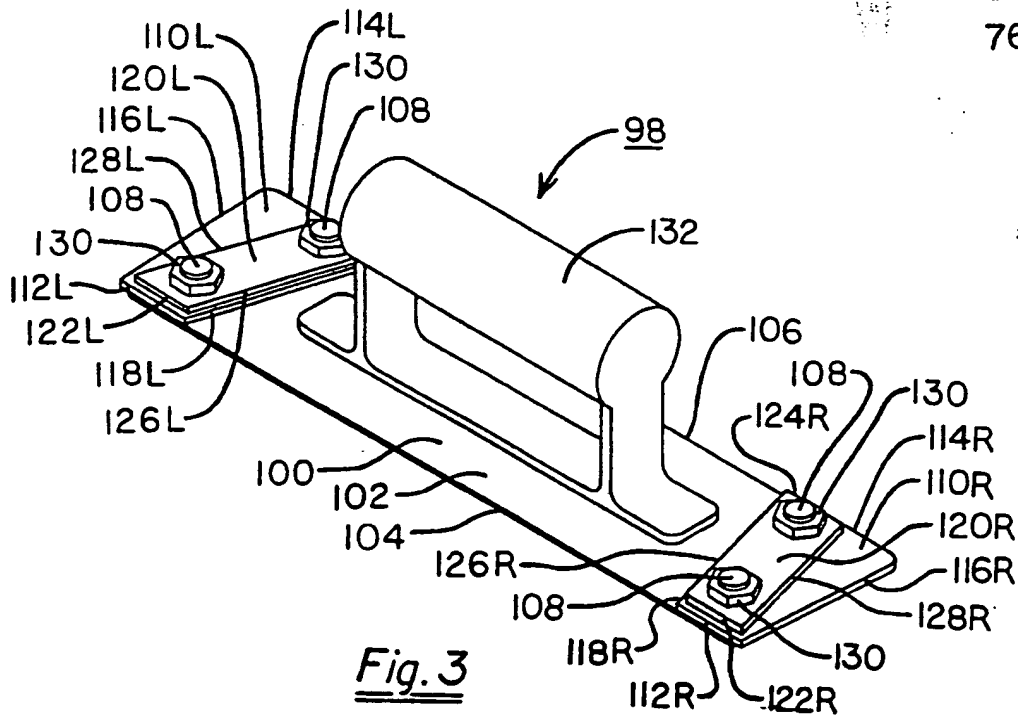


Fig. 3

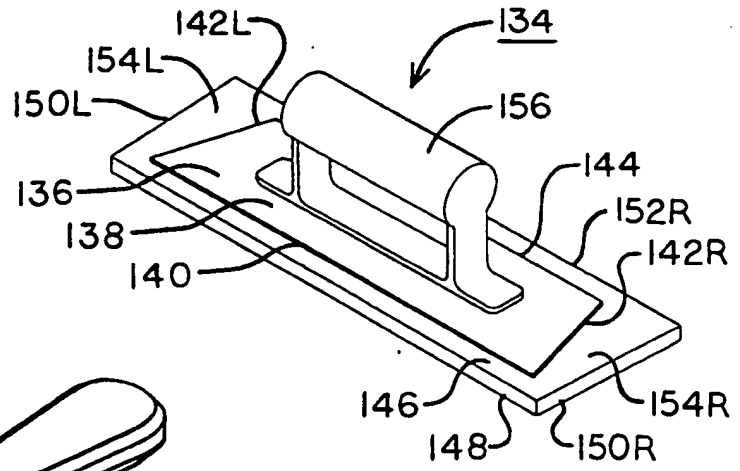


Fig. 4

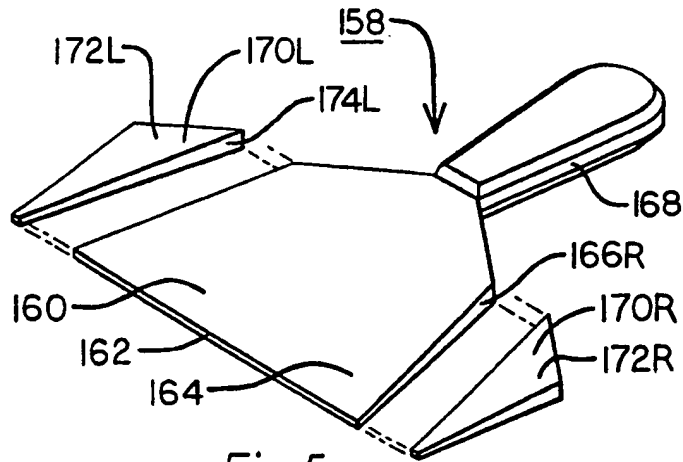


Fig. 5

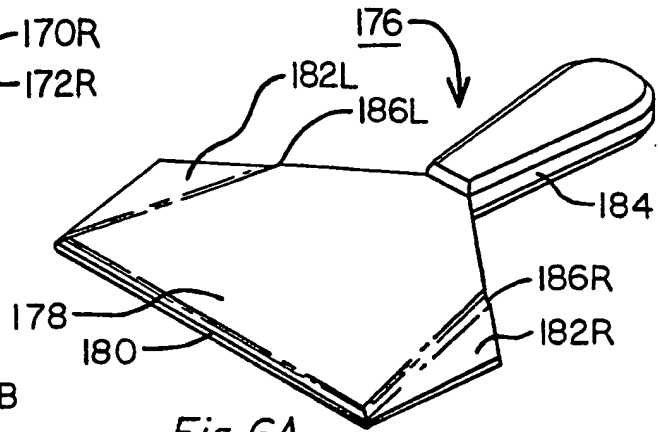


Fig. 6A

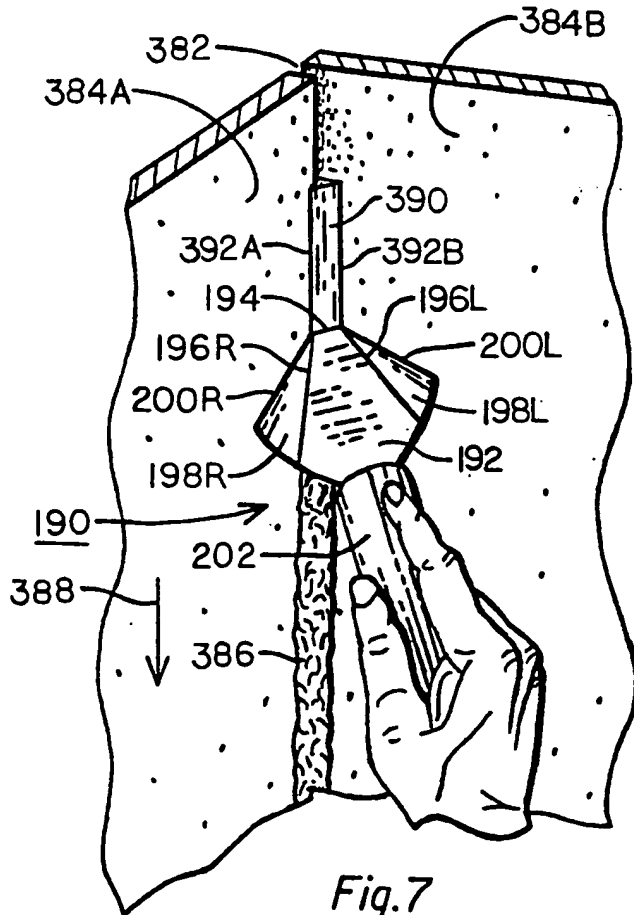


Fig. 7

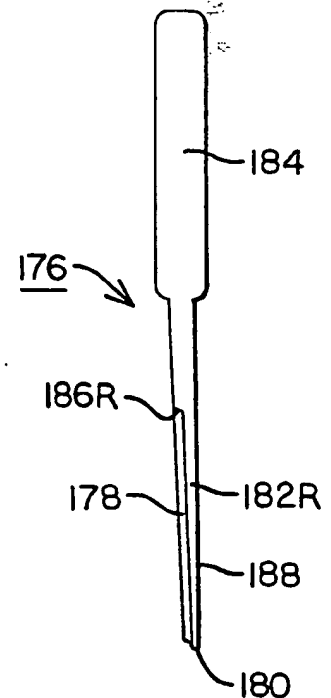
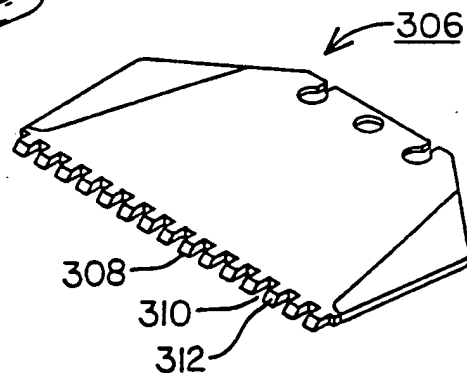
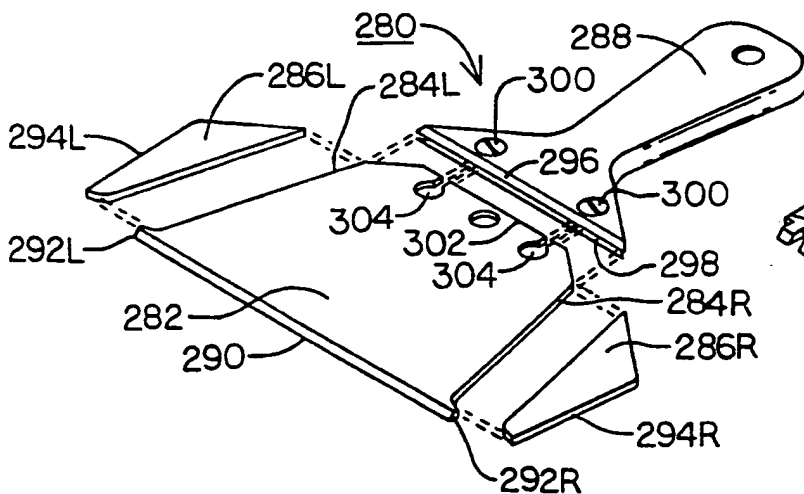
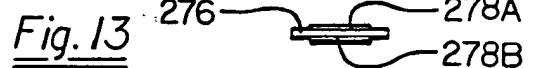
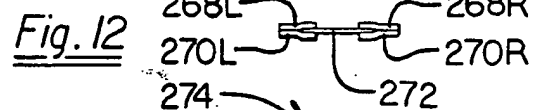
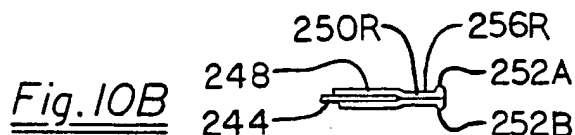
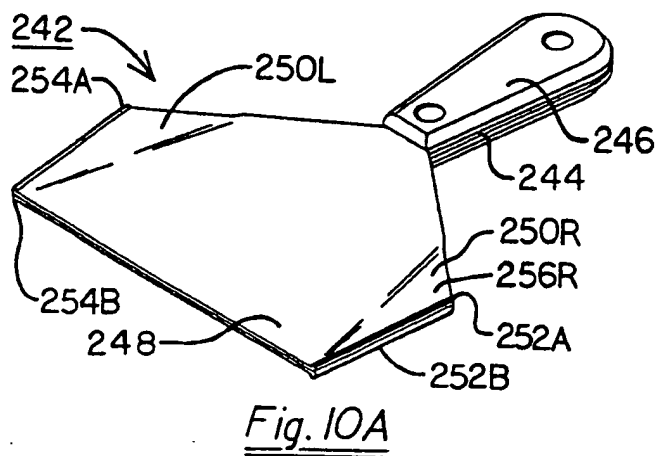
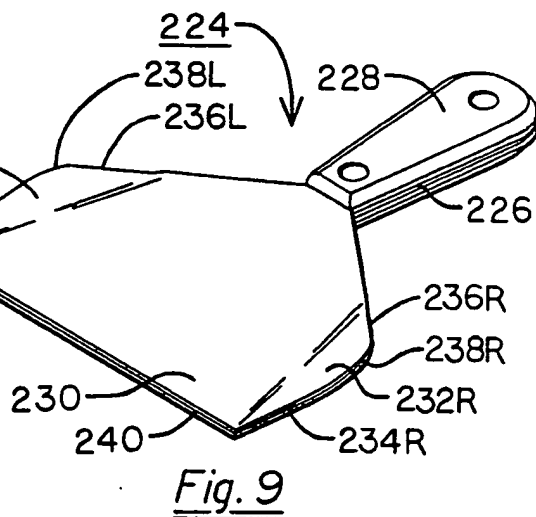
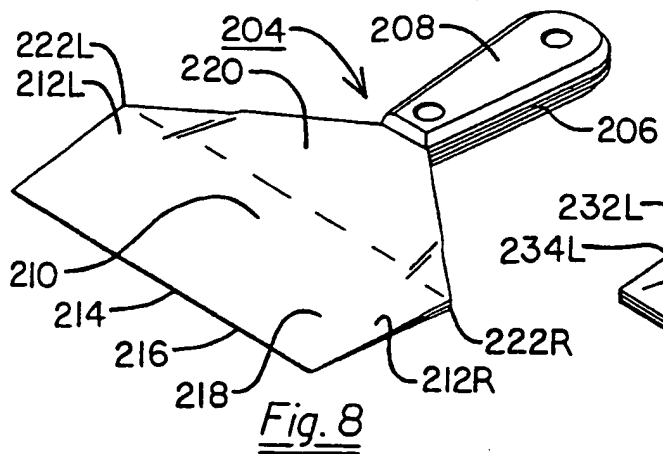


Fig. 6B



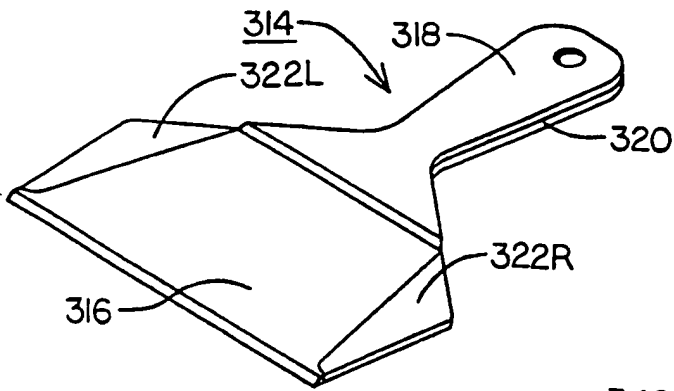


Fig. 16

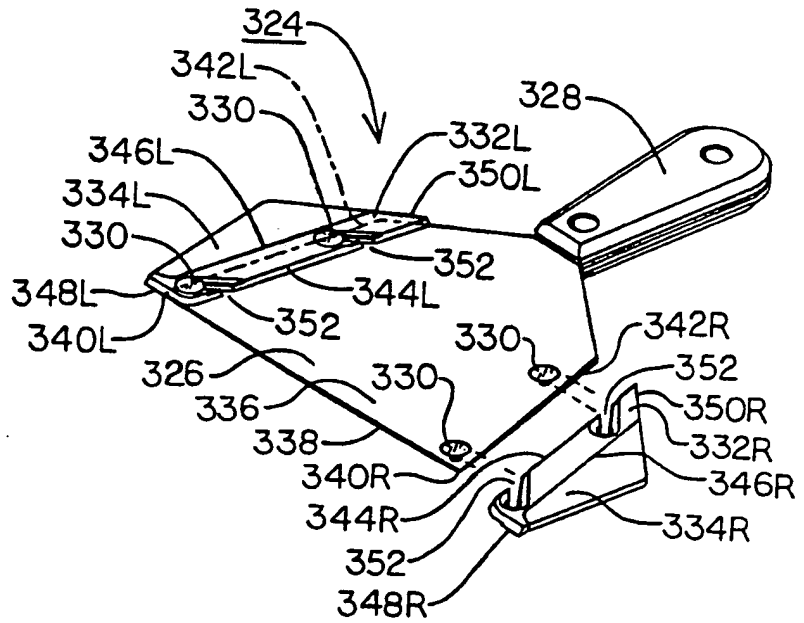


Fig. 17

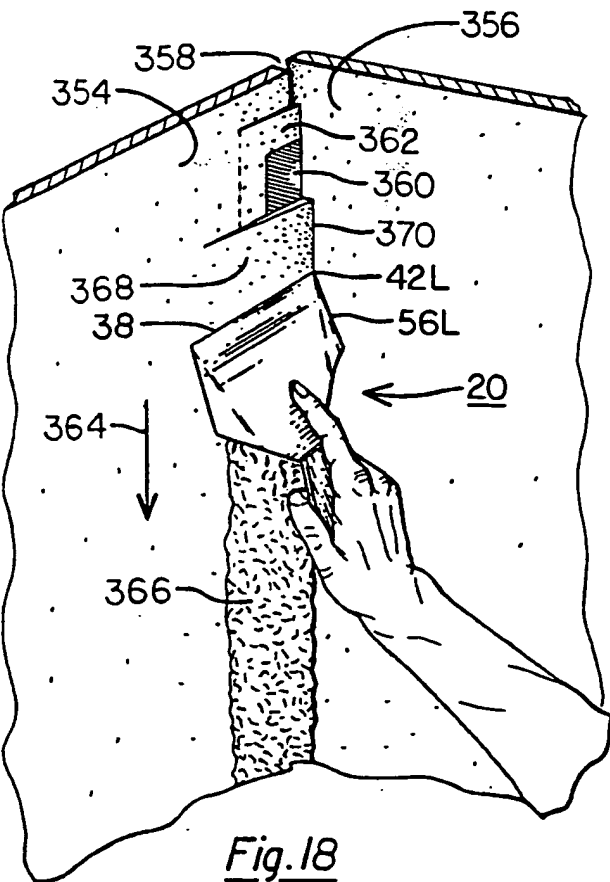


Fig. 18

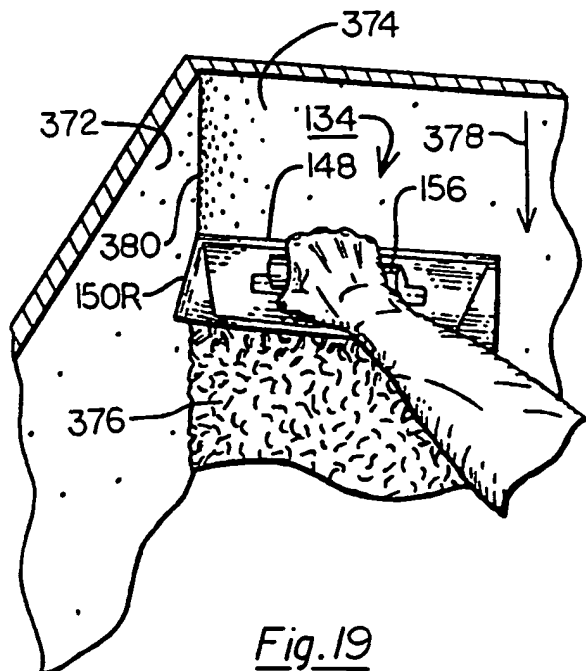


Fig. 19

INTERNATIONAL SEARCH REPORT

PCT/US 93/04437

International Application No

| | | |
|---|--|-------------------------------------|
| I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ | | |
| According to International Patent Classification (IPC) or to both National Classification and IPC | | |
| Int.Cl. 5 E04F21/06 | | |
| II. FIELDS SEARCHED | | |
| Minimum Documentation Searched ⁷ | | |
| Classification System | Classification Symbols | |
| Int.Cl. 5 | E04F ; B05C | |
| Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸ | | |
| III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ | | |
| Category ¹⁰ | Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹² | Relevant to Claim No. ¹³ |
| A | US,A,1 999 367 (MCCORKLE) 30 April 1935 see column 1, line 40 - column 2, line 32; figures 1-4 --- | 1-4 |
| A | US,A,4 669 970 (PERRY) 2 June 1987 cited in the application see column 3, line 8 - column 5, line 53; figures 1-10 --- | 1-4 |
| A | US,A,3 878 581 (PERNA) 22 April 1975 cited in the application see column 1, line 64 - column 3, line 31; figures 1-6 --- -/- | 1-4 |
| <p>¹⁰ Special categories of cited documents : ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> | | |
| IV. CERTIFICATION | | |
| Date of the Actual Completion of the International Search | Date of Mailing of this International Search Report | |
| 18 AUGUST 1993 | 27 -08- 1993 | |
| International Searching Authority | Signature of Authorized Officer | |
| EUROPEAN PATENT OFFICE | AYITER J. | |

| III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET) | | |
|--|--|-----------------------|
| Category * | Citation of Document, with indication, where appropriate, of the relevant passages | Relevant to Claim No. |
| A | US,A,4 619 013 (YON) 28 October 1986 see column 2, line 8 - column 3, line 32; figures 1-6 ----- | 1-4 |
| A | US,A,3 761 992 (SCHNELLER) 2 October 1973 cited in the application see column 1, line 41 - column 2, line 61; figures 1-7 ----- | 1-4 |

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

US 9304437
SA 74126

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
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18/08/93

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| US-A-1999367 | | None | |
| US-A-4669970 | 02-06-87 | None | |
| US-A-3878581 | 22-04-75 | None | |
| US-A-4619013 | 28-10-86 | US-A- 4757572 | 19-07-88 |
| US-A-3761992 | 02-10-73 | CA-A- 956549 | 22-10-74 |

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